TechTIP

Air Force Technology Transition Information Program
An Air Force Publication

ASC/SMA BLDG 28
2145 MONAHAN WAY
WPAFB OH 45433-7017

OFFICIAL BUSINESS

Bulk Rate
U.S. POSTAGE
PAID
TAC
Industries, Inc.

TechTIP SUBSCRIPTION FORM

Full name, unit, and street address; ZIP+4; and phone number are required for valid subscription.

NAME
FIRST ______ MI ______ LAST ______ MIL RANK ______ EFFECTIVE DATE ______

ADDRESS
COMPANY (MAJCOM) ______
DIVISION (OFFICE SYMBOL) ______ MAIL STOP ______
STREET ADDRESS ______
CITY (BASE) ______ STATE ______ 9 DIGIT ZIP CODE ______

☐ NEW
☐ CHANGE
☐ DELETE

PHONE ( ) ______ COMMERCIAL   DSN ______   FAX ______

TechTIPs White Book ☐ 3 ½" Diskettes ☐ Paper Version

SUBSCRIBERS MUST BE U.S. CITIZENS OR U.S. GOVERNMENT EMPLOYEES SERVING IN THE U.S. MILITARY, OR U.S. CITIZENS WORKING FOR U.S. OWNED COMPANIES WHICH HAVE CONTRACTS WITH THE U.S. GOVERNMENT.

M-84.

ASC/SMA BLDG 28
2145 MONAHAN WAY
WPAFB OH 45433-7017

TO: PRODUCT SUBSCRIPTIONS
ASC/SMA BLDG 28
2145 MONAHAN WAY
WRIGHT-PATTERSON AFB OH 45433-7017

FOLD HERE

Editor's Notes

January 1998

This issue of TechTIPs, M-84 includes:

ET98134	Improved Spanwise Splice Inspection
TP032	AFRL/Information Directorate's Interactive Multimedia Presentation System (I-IMPRESS) Developed
SS Issue #3	TechTIP Success Story TTSS003 Safety Wire Substitute
Index	Semiannual Index

Comments or Complaints
If you have any comments or complaints let me know what you think. Is there a particular type article you would like to see? Let me know and I'll see what we can do. Do you have any success stories based on a previously published TechTIP? I'd like to know about them as well.

Previously, I gave you our web site as **www.wpafb.af.mil/base/asc/sma/**. Since our last issue, that address has changed. Our new and improved web address for public access is: **www.wpafb.af.mil/asc/sma/**. Please use this address. If you need any assistance or have any questions/comments, you can contact us at:

ASC/SMA
2145 Monahan Way
WPAFB OH 45433-7017

TechTIPs : DSN 785-7210 x3365/Comm: 937-255-7210 x3365
PRAM: DSN 785-7210 x3357 (Maj Steve Herzig)
SAVE: DSN 785-7210 x3368 (SMSgt Jim Keller)
QUICK RESPONSE: DSN 785-7210 x3366 (MSgt Carl Loden)
AGING AIRCRAFT: DSN 785-6053 x3134 (Ms Debbie Bailey)
COATINGS: DSN 785-9030 (Ms Patricia Valentino)
Fax: DSN 986-4410/Comm: 937-656-4410

You can also e-mail us at: techtips@ntnotes2.ascsm.wpafb.af.mil

Coming next issue:

TA9873	Lawrence Livermore National Laboratory
TP033	AFRL/Materials and Manufacturing Directorate's ManTech Initiatives
TB Issue #34	Technology Bulletin TB0077 Pneumatic Explosion-Proof Vacuum TB0078 New Style Thread Restorer

Terrie L. Morris, Editor

AGING AIRCRAFT PROGRAM OFFICE
ASC/SMA
2145 MONAHAN WAY
WPAFB OH 45433
PH: 937-255-6053   Fax: 937-656-4410

Emerging TechTIP
Air Force Technology Transition Information Program
January 1998 (937) 255-7210 ext 3365 Number: ET98134

Improved Spanwise Splice Inspection

A depot-level, automated ultrasound scanning inspection technique.

Scope

The C-141 System Program Directorate (SPD) at Warner Robins Air Logistics Center (WR-ALC) has identified second-layer cracking of the lower, inner-wing, spanwise splice joints as the life-limiting feature of the C-141 aircraft. Second-layer cracking of the lower wing of C-141 aircraft, with over 43,000 flight-equivalent damage hours, potentially affects over 7,000 fastener sites per aircraft.

As an interim safety measure, the C-141 SPD issued a Time Compliance Technical Order (TCTO) in July 1996 requiring field-level workers to accomplish splice joint nondestructive inspection (NDI) every 120 days using an eddy current surface scan. This inspection method is capable of detecting only surface-breaking cracks and will remain in effect until a new method, capable of detecting smaller inner-tab cracks, can be developed and validated.

The TCTO procedure consists of the following steps: 1) remove the lap-joint sealant bead, as necessary, in the area of inspection; 2) calibrate using lap-joint standards; and 3) inspect the surface. The surface inspection entails scanning a surface probe along the aft lap-joint panel the length of each spanwise joint. The procedure is designed to detect a surface crack < 0.100 inch in length measured from the panel edge. Total crack length at this point of detection (as measured from the inner tab fastener hole) is approximately 1.0 inch

The C-141 SPD requested that the WR-ALC Materials Analysis Team (TIEDM) develop an alternative inspection method capable of detecting 0.125-inch second-layer cracks from the aircraft's exterior without removing fasteners. Based on inner-wing damage-tolerance analysis data, 0.125-inch crack-detection capability would allow a five-year inspection interval for the spanwise joint.

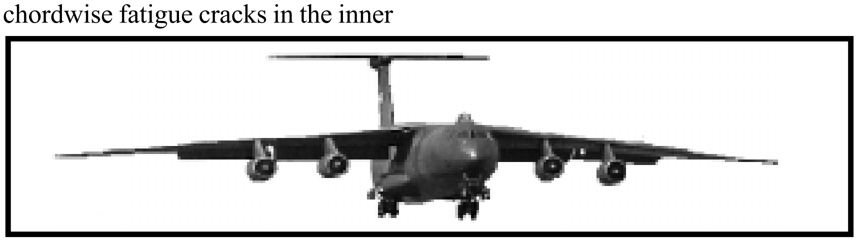
WR-ALC/TIEDM determined the best alternative inspection method available, with potential to meet the specific C-141 SPD requirements, was an automated ultrasonic scanning technique developed under contract by Ultra Image International, a division of Science Applications International Corporation (SAIC). The primary purpose of the SAIC contract effort was to develop a more reliable non-destructive inspection process. SAIC's contract objectives were:

To design, develop, test, and prototype a portable automated ultrasonic scanning inspection process with a detection threshold of < 0.050 inch for chordwise fatigue cracks in the inner tab (second-layer) fastener holes of the C-141 lower inner-wing-panel spanwise splice joints. The process will be accomplished from the wing exterior and require no pre-inspection aircraft preparation, such as coating removal, fastener removal, or couplant application.

The process will be automated to the maximum extent possible and operable by one Level II NDI technician. The process will be self-contained and portable to the maximum extent to allow travel to and around the aircraft in a maintenance hanger environment. Any components attached to the aircraft will be as lightweight as possible. The process will provide for high-speed ultrasonic scanning inspection capable of inspecting a minimum of 100 splice-joint fastener holes per hour and will require fewer than 450 man-hours for complete aircraft inspection.

SAIC delivered a prototype system in February 1997, which consisted of the following components:

- a scanner having a 36-inch x 6-inch scan envelope and weighing approximately 40 pounds;



- a scanner utility system inside the portable cart as a slide-out module that provides regulated air pressure (0 - 45 psi), automatic coupling (water 0 - 35 psi), and vacuum control (18 - 22 inches Hg);
- a 120 MHz Pentium-based computer with a 540 MB hard disk using ULTRA IMAGE IV/Scanmaster Version 9 control system software;
- a tandem transducer head with two opposing shear-wave, pulse-echo, separately gimbaled, transducers configurable to a single or triple transducer arrangement; and
- a portable cart to house all computer controls and accessories.

In February 1997, WR-ALC personnel conducted on-aircraft functional testing of the prototype automated ultrasound scanning technique on a C-141 aircraft undergoing Programmed Depot Maintenance (PDM) inspection. This aircraft had previously been defueled, depainted, and engine pylons removed. A preliminary inspection procedure, based primarily on laboratory testing, was used to conduct the test.

First, the lower wing skin surface was surveyed to determine the plan of action. From the survey it was determined that the first 12 to 18 inches of each splice joint outboard of the center wing/inner wing joint were inaccessible to the automatic scanner. These areas will be scanned in a semi-automatic mode with the aid of a hand-operated manual scanner.

Data are acquired in the same manner as in the automatic mode. A manual scanner was placed into position to verify full coverage of the joint area. Approximately 100 fasteners per wing will require inspection in this manner. Technicians determined that with engine pylons installed, approximately 50 fasteners underneath the pylon could not be inspected; also, the pylon would restrict automatic scanner placement on the inboard and outboard sides, requiring approximately 100 additional fasteners to be inspected with the manual scanner.

A total of 51 scans was performed, with a total of 850 fastener sites inspected; an average of 160 holes were inspected per hour; 20 to 24 fasteners were inspected per set-up. Scanner positioning, scanning, and data analysis took approximately seven minutes per scan. The original goal of the program was 100 fasteners per hour. Technicians have detected two confirmed cracks during functional testing.

A probability of detection (POD) study is currently underway and expected to be complete by the end of December 1997. It is expected that the POD data will prove the new automated scanning process to have a detection threshold equivalent to Bolt Hole Eddy Current (BHEC). With this POD data, the SPD can determine appropriate inspection intervals for the new process.

Benefits/Drawbacks

The spanwise splice cracking problem dictated the need for inspection of the second-layer or inner tab of the splice joint on C-141 aircraft. BHEC is an available, fieldable method capable of detecting 0.070-inch cracks in the inner tab fastener holes; however, its use requires the removal of every splice joint fastener. Cost estimates for BHEC testing of the C-141 spanwise splice-joints range up to 9,000 man-hours per aircraft.

Potential risks associated with BHEC include inducing damage to fastener holes during large-scale removal and reinstallation operations and the degradation of fuel tank sealant integrity. Based on the associated costs and risks, the C-141 SPD determined that BHEC is an unacceptable alternative for large-scale inspection of C-141 spanwise splice joints.

The C-141 SPD's TCTO, an interim safety measure, uses an eddy current surface scan on the exterior surface of the lower, inner, spanwise joints. This inspection is repeated every 120 days on every C-141 aircraft and has become a major manpower burden on field-level NDI personnel. Some high-time aircraft are inspected every 30 days. To date, one splice joint crack has been found with this TCTO.
The SPD goal is to perform a one-time, fleet-wide inspection using the new automated process to assess fleet splice-joint conditions. Once commenced, the fleet inspection is expected to be completed within a 6- to 12- month time period at an estimated cost of $75,000 per aircraft. It is anticipated that a savings of over $100 million will be realized by accomplishing fleet-wide inspection with SAIC's automated ultrasound scanning technique versus BHEC.

Application

Spanwise splice joints on the C-141 aircraft.

Documentation

The prototype portable automated ultrasonic inspection process was an Aging Aircraft initiative funded by Air Mobility Command (AMC).

Technical documentation is available from the POC.

Point of Contact...

Roy T. Mullis, Project Engineer
WR-ALC/TIEDM
420 2nd Street, Suite 100
Robins AFB GA 31098-1640
Commercial (912) 926-4489
DSN 468-4489
Fax (912) 926-1743

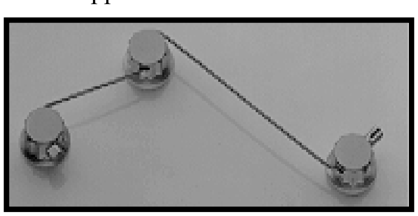
Safety Wire Substitute

Safe-T-Cable™ use saves time and increases productivity.

The following success story is an account of how an engineer at the San Antonio Air Logistics Center (SA-ALC), Kelly Air Force Base, TX, implemented Safe-T-Cable in the Aircraft Engine Overhaul Center (T-56 Final Assembly) and in-turn improved the quality and efficiency of their operations. The SA-ALC/LPPEA engineer, Adrian Salinas, read about Safe-T-Cable in the 29 May 1992 issue of TechTIPs (see Technology Bulletin TB0021, Safety Cable) and initiated a project in August 1992 to consider using this technology as a substitute for safety wire throughout the T-56 engine power section and fuel control.

In September 1992, SA-ALC Engineering (LPPEA), Production (LPPPA), and the T-56 Engine Commodity Office (LPEBT) determined that Safe-T-Cable was an acceptable substitute for safety wire and gave approval to pursue the project.

In October 1993, Mr. Salinas obtained tools from Daniels Manufacturing Corporation (DMC) of Orlando, FL, and later conducted a prototype build/test of the tool. In February 1994, the T-56 Engine Commodity Office approved use of Safe-T-Cable on all Air Force T-56 engines and modules.



Saving time is the main benefit of using Safe-T-Cable (as opposed to safety wire) during engine assembly and disassembly for both depot maintenance and two-level maintenance for the T-56 power section. Using Safe-T-Cable reduces the time for compressor module final assembly from approximately four hours per module to two hours per module. As a result, the productivity capacity for the T-56 power sections and compressor modules has doubled.

The application of Safe-T-Cable has been especially useful in engine areas that have limited access or hard-to-reach or tightly confined areas where the use of safety wire cable is not practical. Some uses include compressor module buildup, fuel nozzles, air inlet, and all external fastener safety wiring.

During disassembly, the mechanic can make a single cut to remove Safe-T-Cable as opposed to making several cuts and having to unravel twisted safety wire. The bottom line is that the end user (the mechanic) likes to use Safe-T-Cable. Using Safe-T-Cable makes jobs easier and helps eliminate Foreign Object Damage (FOD), which is normally associated with the removal of safety wire.

Technical Order (T.O.) 2J-T56-53, Supplement S84 authorizes using Safe-T-Cable with one exception: the C-130 aircraft engine turbine rear exhaust cone. T.O. 1-1A-8, Change 35, provides technical details of the selection and installation process of Safe-T-Cable. The following Safe-T-Cable tools and components are available:

5340-01-414-6582 Standard Safety Cable Kit (consisting of .032 diameter cable assembly and ferrule)

5120-01-440-5129 Safety Cable Application Tool with 7-Inch Nose Assembly

55120-01-413-8725 3-Inch Tool Nose Assembly (.032 diameter cable)

6635-01-416-9870 Safety Cable Tool Torque Verification Block

Additional cable sizes are available.

Points of Contact...

Dave Kelly, Technical Liaison
Daniels Manufacturing Corp (DMC)
526 Thorpe Road
Orlando FL 32824
Commercial (407) 855-6161
Toll Free 1-800-327-2432
Fax (407) 855-6884
E-mail DMCTOOLS@AOL.COM

Adrian Salinas, Production Engineer
SA-ALC/LPPEA, Building 360
661 Duncan Drive
Kelly AFB TX 78241
Commercial (210) 925-7074
Fax (210) 925-7075
E-mail: ASALINAS@LPGATE1.KELLY.AF.MIL

Semiannual

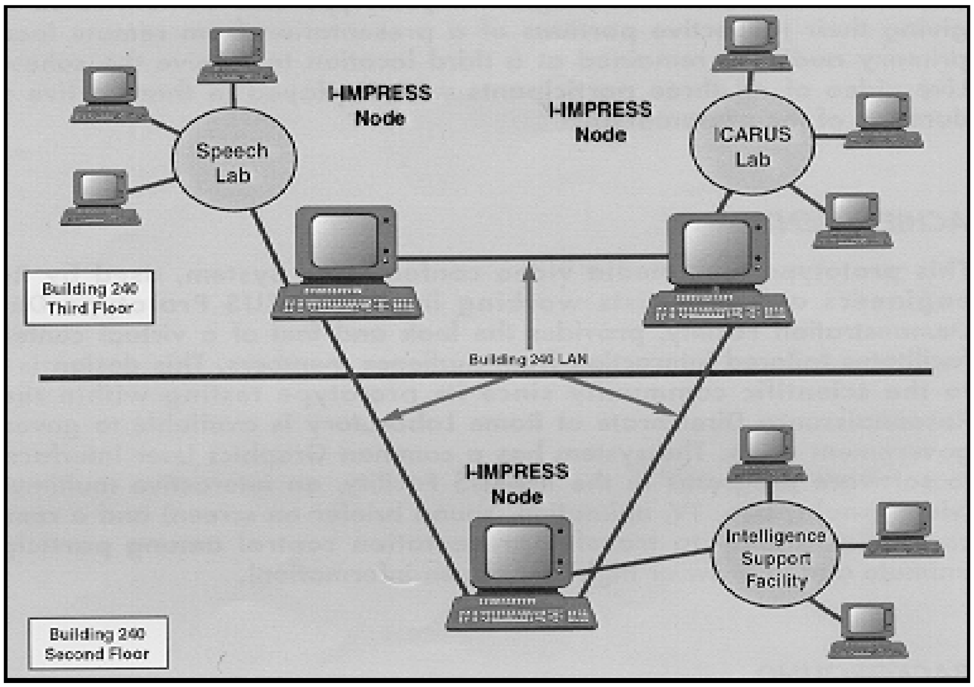
INDEX Air Force Technology Transition Information Program

Number	Publication Title	January 1998
TechTIPs		TechTIP
ET97133	New Tools & Reference List	
ET98134	Improved Spanwise Splice Inspection	
TechTAPs		TechTAP
TA 9772	Savannah River Technology Center (SRTC)	
Technology Bulletins		TECHNOLOGY BULLETIN
TB0075	Pneumatic "Dust-Free" Sander	
TB0076	High Strength ¼" Drive Ratchet	
Emerging Technology Bulletins		Emerging Technology Bulletin
ETB0039	Cuff-mounted Electronic Display Unit	
ETB0040	Wire and Bristle Brush Replacements	
TechTIP Success Story		TechTIP Success Story
TTSS003	Safety Wire Substitute	
Tech Payoffs		Air Force Research Laboratory Tech Payoffs
TP030	Laser Lab Helps Advance MRI Technology for Brain Tumor Imaging	
TP031	Joint Automated Booking Station (JABS)	
TP032	Interactive Multimedia Presentation System (I-IMPRESS) Developed	
Rescinded TechTIP Articles		
TB0059	Canopy Cleaner, Protectorant, and Polish (revision 15 May 96)	27 Oct 95

Air Force Research Laboratory *Tech Payoff*

AFRL/Information Directorate

Interactive Multimedia Presentation System (I-IMPRESS) Developed



The diagram portrays the initial ICARUS-Interactive Multimedia Presentation System (I-IMPRESS) Node Configuration. This shows two briefers making presentations to an audience, all at different locations. Live video in three active windows is displayed simultaneously.

AFRL/Information
Directorate
Rome NY

Payoff

AFRL/Information Directorate and Decision-Science Applications have assembled the prototype I-IMPRESS system, consisting of two commercial off-the-shelf packages working in consonance: Gain Momentum (for multimedia presentation construction) and In-Person (for remote video conferencing). This prototype was demonstrated with two briefers giving their respective portions of a presentation from remote locations, while the primary audience remained at a third location to receive the cohesive presentation. Live video of all three participants was displayed in three active windows for the duration of the presentation.

Achievement

This prototype multimedia video conferencing system, used by AFRL/Information Directorate engineers and scientists working in the ICARUS Prototype Development and Demonstration Facility, provides the look and feel of a virtual conference room and facilitates tailored interaction from audience members. This design is being passed on to the scientific community since its prototype testing within the Information & Intelligence Exploitation Division at the AFRL/Information Directorate is available to government and non-government users. The system has a common Graphics User Interface to allow access to software programs in the ICARUS facility and interactive multimedia presentation (viewgraphs, film, TV, animation, sound briefer on screen) and a remote conferencing capability (ability to transfer presentation control among participants; ability to animate and to draw or highlight screen information).

Background

Multi-Sensor Exploitation Branch has long provided modeling and simulation support to a variety of Intelligence consumers, suppliers and analysts, across a wide spectrum of technology areas. This support includes basic and applied research and development in the emerging and enabling technologies of Modeling and Simulation, proof of concept, and feasibility prototype development efforts. In addition, this branch has contributed significant engineering support and ultimate transition of these emerging technologies into system and component designs as well as providing support to field exercises and operational systems.

Additional Information

To receive more information about this or other activities in AFRL/Information Directorate, contact Joseph Turczyn, AFRL/IFP, DSN 587-3047, commercial (315) 330-3047.